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User Manual

Connection to Siemens S7 TCP

Part Number:	80 860.678
Version:	2
Date:	2008-02-01
Valid for:	TSwin .net 4.2

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Version	Date	Modifications
1	2005-11-18	First edition
2	2006-02-01	New layout, protocol parameters note added, protocol parameter „Offline operation“ added

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1 Important Notes

1.1 Symbols

The symbols in this manual are used to draw your attention on notes and dangers.

Danger
This symbol is used to refer to instructions which, if ignored or not carefully followed could result in personal injury.

Note
This symbol indicates application tips or supplementary notes.

Reference to source of information
This symbol refers to detailed sources of information on the current topic.

1.2 Safety Notes

- Read this manual carefully before using the software. Keep this manual in a place where it is always accessible to all users.
- The user manual, in particular the safety notes, must be observed by all personnel working with the software and the programmed device.
- Observe the accident prevention rules and regulations that apply to the operating site.
- Installation and operation must only be carried out by qualified and trained personnel.

1.3 Intended Use

- The software has to be used for programming operating devices exclusively. Every other use is not permitted.

1.4 Target Group

All configuration and programming work in connection with the automation system must be performed by trained personnel only (e.g. qualified electricians, electrical engineers).

The configuration and programming personnel must be familiar with the safety concepts of automation technology.

2 Siemens S7 TCP

The protocol Siemens S7 TCP allows you random read and write access to almost all data types.

The protocol supports connection of an operating device to up to 16 participants at the same time.

The operating device has always client function.

You connect the operating device to the network using the ethernet interface.

2.1 Data Types

Direct access is possible to the following data types.

Table 2-1 Data types Siemens S7 TCP

Type	Mnemonik	From	To		From	To	Access
Input	E	0.0	16383.7				Read/Write
	EB	0	16383				
	EW	0	16382				
	ED	0	16380				
Output	A	0.0	16383.7				
	AB	0	16383				
	AW	0	16382				
	AD	0	16380				
Flag	M	0.0	16383.7				
	MB	0	16383				
	MW	0	16382				
	MD	0	16380				
Counter	Z	0	512				Read Only
Timer	T	0	512				Read Only
Data Block	DB	0	8192	DBX	0.0	65535.7	Read/Write
				DBB	0	65535	
				DBW	0	65534	
				DBD	0	65532	

2.2 Programming

2.2.1 Protocol Parameters

2.2.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 2-2 Maximum waiting time for response

Configurable Values	Default Value
0 s to 10000 s	10 s

2.2.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 2-3 Delay until connection set-up

Configurable Values	Default Value
0 s to 255 s	5 s

2.2.1.3 Offline Operation

Check the Offline operation check box to write communication errors to the message buffer without reboot of the project.

If the check box is not checked the communication error is displayed at the operating devices display and afterwards the project is rebooted.

Table 2-4 Offline operation

Configurable Values	Default Value
OFF	X
ON	

2.2.1.4 Connections

The operating device supports 16 connections at a time.

The connections list consists of 16 lines for the connections an 4 columns for the connection parameters.

Table 2-5 Connections, Siemens S7 TCP

Column	Meaning	Default Value
Connection	Connection Number	1 to 16
IP address of controller	Address of the communication interface	0.0.0.0
Slot number	Number of the slot, where the module is put on	0
Rack number	Rack number of the controller	0

The number of MPI participants depends on the S7 CPU that is used.
Follow the respective operating instructions of the control to this.

2.2.2 Input Syntax

The following image illustrates the structure of the input syntax for variables in the programming software.

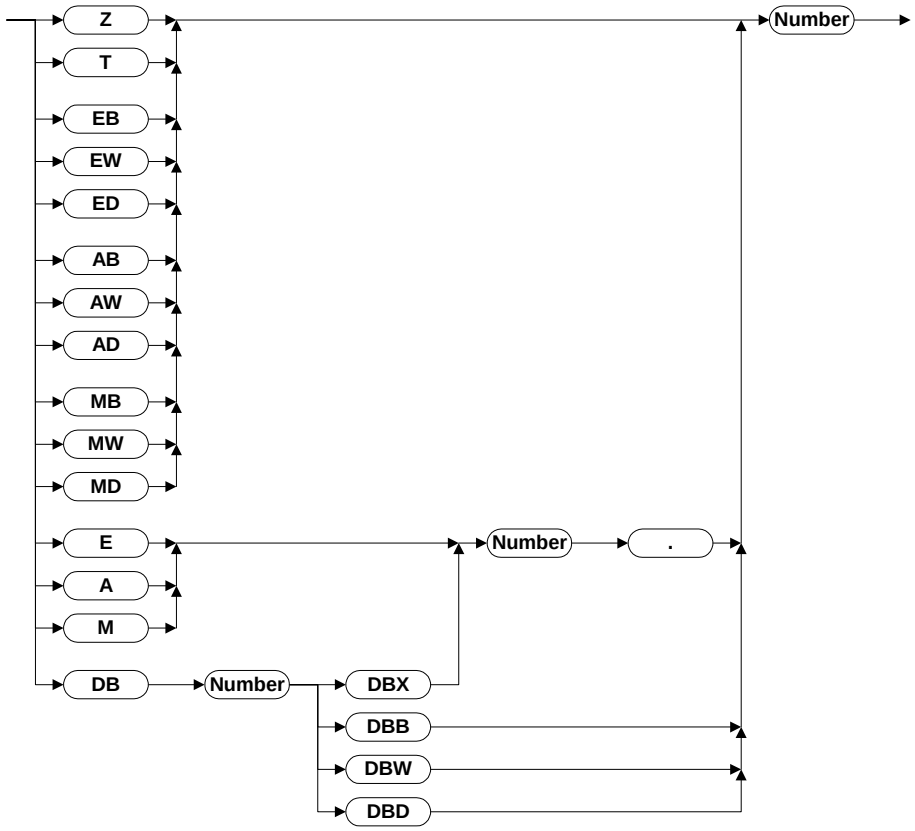

Figure 2-1 Syntax diagram

2.2.3 Status Messages

You have to assign a byte or word address for the parallel message system in the flag area or in a data block (MB. MW, DBB or DBW).

Example:

Table 2-6 Parallel message system Siemens S7 TCP

Word address	Reference	High Byte	Low Byte
Word address + 0	MW 10	Messages 9 to 15	Messages 0 to 8
Word address + 1	MW 12	Messages 24 to 31	Messages 16 to 23
Word address + 2	MW 14	Messages 40 to 47	Messages 32 to 39

2.2.4 Polling Area

You should use byte or word addresses in the flag area or in a data block if you like to use the polling area function. Please enter the start address of the polling area in **Additional Functions, Polling Area**.

Table 2-7 Byte accessed polling area Siemens S7 TCP

Byte address	Reference	High Byte
Byte address + 0	MB 12	WCB
Byte address + 1	MB 13	Message Channel Low Byte
Byte address + 2	MB 14	Message Channel High Byte
Byte address + 3	MB 15	LED 1 to 4
Byte address + 4	MB 16	LED 5 to 8
Byte address + 5	MB 17	LED 9 to 12
Byte address + 6	MB 18	LED 13 to 16
Byte address + 7	MB 19	LED 17 to 20
Byte address + 8	MB 20	LED 21 to 24
Byte address + 9	MB 21	LED 25 to 28
Byte address + 10	MB 22	LED 29 to 32

Table 2-8 Word accessed polling area Siemens S7 TCP

Word address	Reference	High Byte	Low Byte
Word address + 0	MW 20	WCB	Reserved
Word address + 2	MW 22	Message Channel High Byte	Message Channel Low Byte
Word address + 4	MW 24	LED 1 to 4	LED 5 to 8
Word address + 6	MW 26	LED 9 to 12	LED 13 to 16
Word address + 8	MW 28	LED 17 to 20	LED 21 to 24
Word address + 10	MW 30	LED 25 to 28	LED 29 to 32

2.2.5 Physical Connection

The operating devices are connected to the network via the ethernet interface.

2.2.5.1 Pin Assignment

Connector in the operating device: RJ45 female connector.

Table 2-9 Assignment of the Ethernet interface

Pin	Designation	Function
1	Tx+	Transmitted Data, Positive Polarity
2	Tx-	Transmitted Data, Negative Polarity
3	Rx+	Received Data, Positive Polarity
4	n.c.	Not Connected
5	n.c.	Not Connected
6	Rx-	Received Data, Negative Polarity
7	n.c.	Not Connected
8	n.c.	Not Connected

2.2.5.2 Cable

A twisted pair cable of the category 5 (CAT 5) type must be used. The maximum cable length is 100 m (328.084 feet).

See the IEEE 802.3 standard for further information.

2.3 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows:

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 2-10 Error messages for Siemens S7 TCP

Code	Subcode	Error Type	Possible Cause
10		Connection errors	
	1	Timeout	Requested controller not available or no longer available. Remidy: Generate further read and write commands, to reset the connection by the driver automatically. Possibly encrease the value for "Delay until connection set-up".
	4	Timeout	No response from control
	5	General error	Netword not running. Remidy: Install TCP/IP. Install Winsocket. Check settings for polling. area or parallel message system.
	6	Target controller not found	Wrong rack or slot number. No free connection for this slot. Remidy: Check the configuration of the communication module in the SIMATIC Manager.
	99	Invalid reference number	Possibly the variables list contains a connection number that is not defined in the protocol parameters.

Table 2-10 Error messages for Siemens S7 TCP

Code	Subcode	Error Type	Possible Cause
20		TCP socket errors	
	10004	Interrupted system call	
	10013	Permission denied	
	10014	Bad address	
	10022	1. Other function must be called before 2. Socket already assigned to address 3. Socket not assigned to address	
	10024	Missing resources (files, queues)	
	10035	Operation would block	
	10036	Operation now in progress	
	10037	Operation already in progress	
	10038	Socket operation on non-socket	
	10039	Destination address required	
	10040	Message too long	
	10042	Bad protocol option	
	10043	Protocol not supported	
	10044	Socket type not supported	
	10045	Operation not supported on socket	
	10046	Protocol family not supported	
	10047	Address family not supported by protocol family	
	10048	Address already in use	
	10049	Can't assign requested address	
	10050	Network is down	
	10051	Network is unreachable	
	10052	Net dropped connection or reset	
	10053	Software caused connection abort	
	10054	Connection reset by peer	
	10055	No buffer space available	
	10056	Socket is already connected	
	10057	Socket is not connected	
	10058	Can't send after socket shutdown	
	10060	Connection timed out	
	10061	Connection refused	
	10065	No Route to Host	
	10091	Network SubSystem is unavailable	
	10092	WINSOCK DLL Version out of range	

Table 2-10 Error messages for Siemens S7 TCP

Code	Subcode	Error Type	Possible Cause
20	10093	Successful WSASTARTUP not yet performed	
	11001	Host not found	
	11002	Non-Authoritative Host not found	
	11003	Non-Recoverable errors: FORMERR, REFUSED, NOTIMP	
	11004	Valid name, no data record of requested type	
30		Data errors	
	2	Error on accessing data block	Data block is not present or address is outside the data block range
	9	Value too large	Wrong value for counter (<=999) or Timer (<=9990000 ms).
	10	Wrong data type	Data type is not supported. Remidy: Check the variables list
40		Hardware errors	
	8	Memory error	Cannot allocate memory area for data. Possibly the operating device is faulty. Remidy: Check the application size. Send the operating device to our service.

2.4 Applications

The following application shows how to establish a connection from the operating device to the controller via ethernet.

2.4.1 Hardware

You will need the following to build-up the example application:

– Controller Siemens S7 300 or Siemens S7 400 with power supply, rail, etc.
– Communication processor with ethernet interface, i.e. CP343-1 IT for S3 300
– Operating device with Windows CE operating system
– Hub or Router
– Ethernet cable (Patch, CAT5)
– Ethernet network (server, etc.)
– Power supply 230 VAC / 24 VDC

Buid-up the hardware components and connect them correctly.

1. Buid-up the controller of the rail.
2. Connect the controller and the operating device with the power supply.
3. Connect the hub or router with the ethernet network.
4. Connect either the controller and the operating device with the hub or router.
5. Plug-in the power supply.

2.4.2 Settings in SIMATIC Manager

2.4.2.1 Assigning the IP Address

To make the controller accessible to other participants in the ethernet you must assign an IP address in the SIMATIC Manager.

1. Open the dialog **Properties** with a double click on the communication processor (CP343-1 IT) icon.

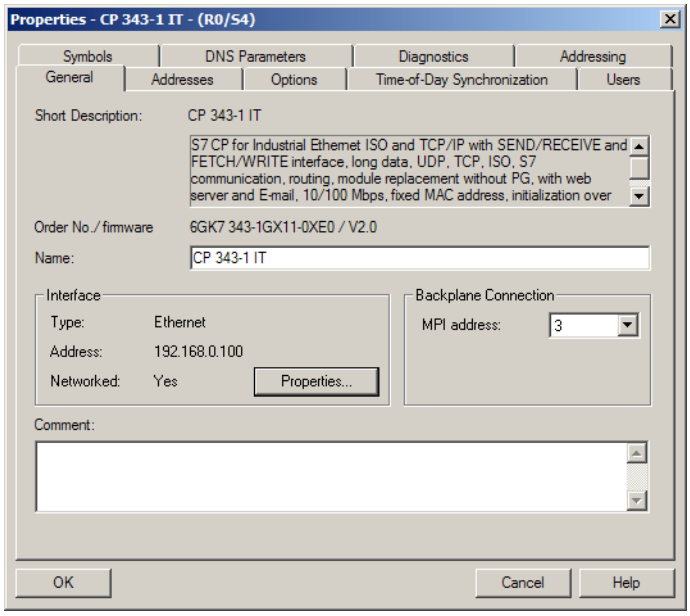

Figure 2-2 Properties dialog, General tab

2. Click on the **Properties** button..

The **Properties - Ethernet interface** dialog opens.

3. Open the **Parameters** tab.

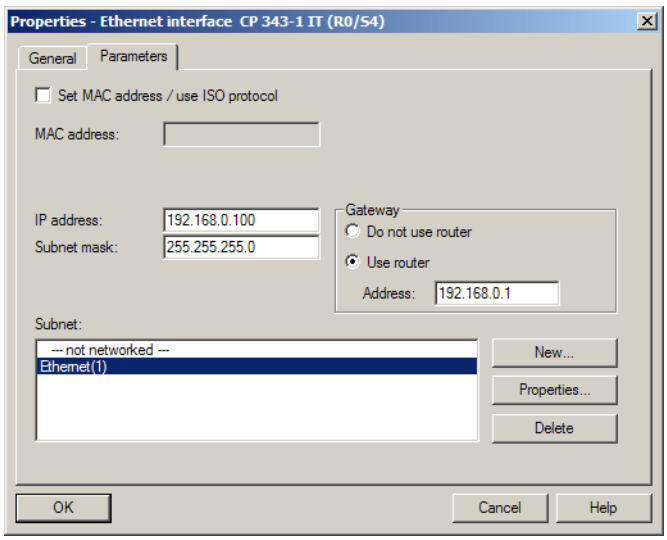

Figure 2-3 Properties - Ethernet interface dialog, Parameters tab

If you are using a router:

4. Select **Use router** in the Netgateway area.
5. Enter an IP address that is assigned tightly to the controller (i.e.: 192.168.0.100).
6. Enter the IP address of the router (i.e.: 192.168.0.1).
7. Confirm with **OK**.

In addition you have to configure the router in a way that makes the controller permanently reachable with the assigned IP address (i.e.: 192.168.0.100).

If you are not using a router:

8. Enter an IP address that is assigned tightly to the controller (i.e.: 192.168.0.100).
9. Enter the subnet mask, if necessary (i.e.: 255.255.255.0).
10. Confirm with **OK**.

2.4.2.2 Cycle Load due to Communication

The parameter **Cycle load due to communication** defines as a percentage by how many milliseconds the cycle time may be charged by the communication.

You assign this in the SIMATIC Manager in the hardware configuration / CPU properties. The default setting is 20 %.

Here the cycle time encreases by the corresponding value (at 100 ms up to 20 ms = 120 ms maximum).

The **Cycle load due to communication** may amount between 10% and 50%.

Make sure that you don't exceed the cycle supervision time!

For cycle times in the range of 1 ms to 50 ms you can accelerate the screen build-up time by a higher allowed communication load enormus. However, the complete cycle time is extended correspondingly and so the reactions of the control sluggish through this.

2.4.3 Settings in TSwin

To enable a communication with the controller you have to define a connection.

1. Open the **Communication** branch of the project tree.
2. Mark the protocol item **Siemens S7 TCP**.
3. Click on the **Edit** button in the **Properties** window.

The **Protocol parameters Siemens S7 TCP** dialog opens.

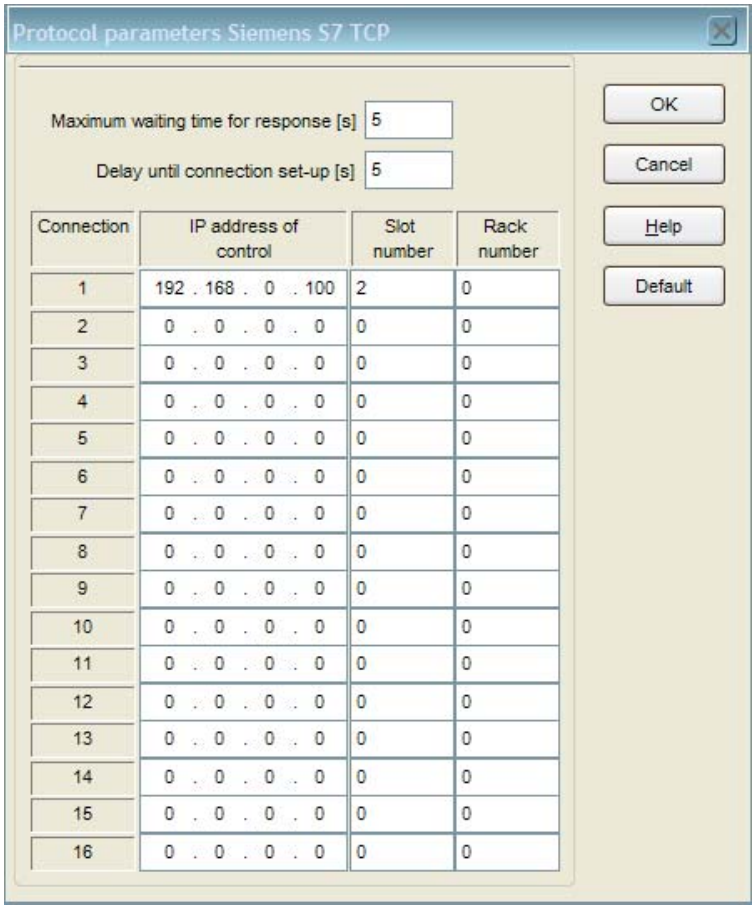
Protocol parameters Siemens S7 TCP
Maximum waiting time for response [s] 5
Delay until connection set-up [s] 5
OK
Cancel
Help
Default
Connection
IP address of control
Slot number
Rack number
1 192 . 168 . 0 . 100 2 0
2 0 . 0 . 0 . 0 0 0
3 0 . 0 . 0 . 0 0 0
4 0 . 0 . 0 . 0 0 0
5 0 . 0 . 0 . 0 0 0
6 0 . 0 . 0 . 0 0 0
7 0 . 0 . 0 . 0 0 0
8 0 . 0 . 0 . 0 0 0
9 0 . 0 . 0 . 0 0 0
10 0 . 0 . 0 . 0 0 0
11 0 . 0 . 0 . 0 0 0
12 0 . 0 . 0 . 0 0 0
13 0 . 0 . 0 . 0 0 0
14 0 . 0 . 0 . 0 0 0
15 0 . 0 . 0 . 0 0 0
16 0 . 0 . 0 . 0 0 0

Figure 2-4 Protocol parameters Siemens S7 TCP dialog

4. Enter the same IP address like in the properties of the ethernet interface of the communication module or the router (i.e.: 192.168.0.100).
5. Enter the concrete slot and rack number (i.e.: 2 and 0).
6. Confirm with **OK**.

If you enter an address for a controller variable in TSwin you have to assign the variable name, the address and the connection number.

Example:

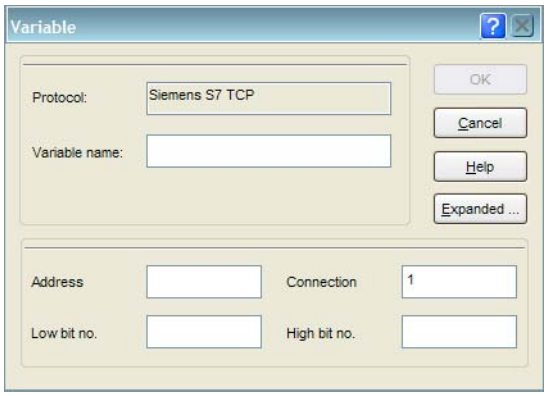

Figure 2-5 Variable, protocol Siemens S7 TCP dialog

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